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Presidents' Conference Committee (U.S.)

A memorandum of the consideration of the...

Philadelphia, Pa.

[1916]

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A MEMORANDUM OF THE CONSIDERATION OF THE ENGINEER'S REPORT TEXAS MIDLAND RAILROAD

BY THE WESTERN GROUP

OF THE ENGINEERING COMMITTEE

PRESIDENTS' CONFERENCE COMMITTEE

MAY 26, 1916

OFFICE OF
GENERAL SECRETARY
PRESIDENTS' CONFERENCE COMMITTEE
PHILADELPHIA, PA.

MRN, June 26, 17

A MEMORANDUM OF THE CONSIDERATION OF THE ENGINEER'S REPORT.

TEXAS MIDLAND RAILROAD.

WESTERN GROUP ENGINEERING COMMITTEE.

On receipt of inventory report of engineer on quantities obtained and unit prices applied to the property of the Texas Midland Railroad, the Engineering Committee of the Western Group gave it such consideration as the short time allowed would permit. The following comments are submitted as confirming the oral presentation of the views of the Committee as made to Director Prouty on May 26, 1916.

The report was not in such detail as permitted analysis of the various results obtained, and there remained only the one course of general discussion and citation of supporting data.

The construction program developed was considered too short, and not in accord with customary experience.

As outlined it precludes the economical erection of bridges, the laying of track, or the ballasting of same. It demands a disposition of construction forces such as no contractor would agree to put on the work at anything like reasonable prices, and contemplates prosecution of work at a speed that is not obtained by carriers having at their disposal the efficient forces of a fully organized company.

It assumes conditions that apply to construction of extensions by carriers already in existence and apparently makes no allowance for the problems arising in the development of a new organization or corporation.

The engineering allowance was considered to be entirely too low, and apparently contemplated the least possible expense to that account. It should be remembered that the most economical construction only results when sufficient and

efficient engineering forces are provided, and that a thousand dollars saved in charges to that account may mean tens of thousands of dollars unnecessarily expended and charged to construction accounts, and for these reasons it is felt that not only is the engineering allowance too low, but it would preclude carrying out the general program along the lines laid down in the report.

Certain assumptions as to procedure can hardly be realized in actual construction.

The large amount of bridging must certainly interfere with the progress of work, no matter whether constructed in advance of track-laying or by track outfits as the various openings are reached.

In arriving at Cost of Reproduction less Depreciation the local conditions such as service required, and maintenance, do not seem to have been given proper consideration.

The service assigned to life of material and structures seems too short in view of the actual service to date, the service required, and the condition in which these structures have been maintained.

The prices applied are in many cases those obtaining during the time when road was constructed. At that time there was a condition of depression that resulted in the lowest prices for labor and material that have been known for many years, and they cannot be considered as representative of average prices as of 1914.

GENERAL STATEMENT.

The Texas Midland as shown by the report embraces 124.61 miles, of which 110.64 miles are owned, and 13.97 miles operated under trackage rights.

It is in fact a line of two distinct parts connected by a foreign line—one part 37.629 miles and the other 73.015 miles in length. This fact together with the various physical conditions encountered precludes the development of an economical and at the same time rapid program of construction, these points being brought out in the discussion of the various subjects hereafter considered.

TOPOGRAPHY, GEOLOGY AND CLIMATE.

The black-waxy soil encountered in all the valleys and on most of the hills in this section is very difficult to handle except when quite dry. During the rainy season it is impracticable to attempt grading.

The soil on the hillsides has some gumbo characteristics which makes handling difficult when wet. The average annual rainfall of twenty-eight inches, as given in the D. V. Report is too little. Experience of roads in that territory is that the rainfall is much greater and Mr. Wells states it should be thirty-three inches or more.

Government records show that at Greenville, Texas, which may be considered as representative of that locality, the average annual rainfall for the years 1900 to 1909, inclusive, was 39.1 inches and that for years 1912 to 1914 the average was 42.2 inches, and for the year 1914, "as of the date of valuation," of the Texas Midland, the total rainfall was 46.16 inches. The attached diagram (Appendix "C") shows the normal monthly rainfall and the annual rainfall at Greenville 1900 to 1914, inclusive.

The soil and rainfall conditions operate not only to influence the prices that would be demanded by contractors for handling material of this nature, but also to determine the length of time required to do such work.

Considering these influencing factors, as well as the total length of the line, and its division into two distinct parts, an economical construction program to bring about the completion of the work would require considerable time.

CONSTRUCTION PROGRAM.

The report cites the various points along the line of the railroad where connections with other roads are made, and assumes that materials and supplies will be delivered at such points for use in construction work.

Because these points exist cannot be taken as reason for their use for such purposes—and allowances for material haul, etc., should not be wholly based on such facts. The accessibility of a point does not in itself determine that it should be so used.

Such assumptions would entail increased store-yard facilities, increased labor operating same, increased construction equipment and increased accounting work.

The Committee has considered and presents a program of construction for a short line of this character, allocating to the various periods such time as will be required to properly and economically complete the construction, making a total period of thirty months.

The plan as developed is according to present-day methods adopted by carriers in building extensions having similar mileage, and their method may reasonably be assumed to be the most economical at this time.

PERIOD 1—FOUR MONTHS.

Reconnoissance, preliminary surveys and estimates.

Financing and making such arrangements as will insure availability of funds when needed.

Incorporation under State laws.

Until these preliminaries are completed, no other work can be undertaken.

PERIOD 2—EIGHT MONTHS.

Final surveys, locations and estimates, and making reports.

This work must of necessity be complete in detail because of the requirements of State commissions and governing bodies.

Compliance with requirements of State public service commissions and securing permits from various other governing bodies.

Sales of securities.

Acquisition of right of way.

Letting contracts and assembling contractors' forces and plants.

It may reasonably be assumed that all of these may be under consideration and execution during this period, and that purchase of right of way, while not completed, will have so far progressed as to permit contractors to enter upon the work.

PERIOD 3—EIGHTEEN MONTHS.

Construction.

This covers the entire construction period up to the time the road may be opened for operation, but it does not take into consideration the period subsequent to that date during which the solidification of the road progresses and requires no little construction work above the normal cost of maintenance.

Such a construction program contemplates the establishment of material yards at Paris, Greenville and Ennis. Material for certain structures may be delivered at other points for team haulage out on the line, but the greater proportion of material would be assembled at the points mentioned so as to be available when needed, and hauled to the front by construction trains. It contemplates two construction divisions, subdivided into such residencies as may be deemed as large as can be well supervised by an engineer and his party. It also takes into consideration the construction delays that may reasonably be expected, such as delays to grading because of wet weather and to bridge work because of high water, possible slow deliveries of material, and consequent delays to track-laying and surfacing and erection of buildings.

Based upon the foregoing and upon general experience of such construction problems, the assumption in the report that "from the beginning of the reconnoissance surveys to the placing of road in service would require eighteen months" is not warranted in the light of actual construction experience, and this Committee confidently believes that thirty months is the least time that should be allowed for such a program.

In support of the above statements, the following cases are submitted showing the actual experience of carriers building extensions of their lines in adjacent or similar territory to that under consideration. The dates and time shown are from the time grading actually began until track-laying was done but not ballasted, and do not show the time required for preliminary surveys, location, letting contracts, and contractors organizing and moving onto work.

Time required to grade and lay track on extensions of certain railroads in territory similar to that of the Texas Midland Railroad.

Line	Length	Cu. Yds. Per Mile	Grading Begun	Track Completed	Months
G., C. & S. F.—Lometa West Extension	97.27	27,590	Mar., 1910	Dec., 1911	21
A., T. & S. F.—Dodge City-Elkhart	119.40	14,390	Feb., 1912	Sept., 1913	19
C., R. I. & P.—Little Rock Southern Extension	144.40	30,700	Apr., 1905	April, 1907	24
C., R. I. & P.—Arkansas & Louisiana-Alexandria Sou.	55.70	25,000	June, 1906	Mar., 1908	22
C., R. I. & P.—Tucumcari-Memphis	41.10	4,000	Feb., 1909	Feb., 1910	12
Ft. W. & R. G.—Brady-Menard	43.48	20,000	Nov., 1909	Mar., 1911	17
M., K. & T.—M., K. & O. R. R.	271.44	24,400	May, 1902	Mar., 1904	23
M., K. & T.—Texas & Oklahoma R. R.	118.16	32,200	Jan., 1903	Mar., 1904	15

In addition to the time above noted, the time required to make surveys, estimates, reports, secure proposals from contractors, award contracts and for contractors to organize and move onto work, required periods varying from about eight months in the case of the Lometa Extension, to about twelve months for the Dodge City-Elkhart Line, both exclusive of reconnoissance and preliminary investigation work which in cases of existing carriers often requires much time of the established engineering organization.

It must be remembered that in all the cases cited these lines were constructed by carriers already in existence, having adequate organizations and facilities immediately available and were, as is usual in such cases, pushed with the customary energy demanded by carriers when extensions are authorized.

It must also be remembered that such lines are financed by the carriers building them and that funds were made available as needed, which would not be the case in the construction of a line by a new corporation having no such facilities.

The assumption that "materials for culverts and small bridges would be hauled by wagon and teams from the nearest common point" does not seem to be carried out in the details of the Division of Valuation estimate.

Again the assumption that construction of certain structures will commence simultaneously with grading work ignores the fact that the large amount of preliminary work such as preparation of plans, grading, etc., precludes that possibility, and besides, the buildings needed by a carrier can rarely be decided upon until after construction work is well under way.

Finally, the assumption of a total survey and construction period of eighteen months contemplates an organization of engineering and construction forces far greater than would be considered good practice in actual work.

UNIT PRICES.

Quoting from the report: "—are representative prices of railway property constructed or purchased by the usual methods of railway construction—for property under contract unit prices are representative of unit costs."

It should not be assumed that contract prices are reflective of entire prices for construction.

A contractor's unit prices of bid do not cover the extras and miscellaneous items of cost that must, if allowance be obtained therefor, be included in the unit prices applied in pricing the inventory.

No roads are constructed without such extras—as for instance transportation of men, outfits and materials and the many smaller contingencies not covered by the contract.

The details given by which unit prices are determined are not such as to permit of analysis.

Because of this, it has seemed important to offer supporting data in such detail as will make clear the contention of this Committee, wherein exceptions are taken to the prices applied in the report of the District Engineer of the Division of Valuation.

This supporting data is made up largely from the actual experience of carriers in northern Texas, western Louisiana and Oklahoma, and may be assumed to represent the average price that would obtain on the Texas Midland. Information furnished by carriers in other localities has been used where it seemed that it was applicable to Texas Midland conditions. Contingent costs, that should be allowed to various items in arriving at unit costs, are an important factor that do not seem to have been allowed.

ENGINEERING.

The report estimates engineering expenses at an amount equalling $496 per mile of road, or approximately 2.1 per cent. of Road Accounts 3 to 47.

The above rate per mile and per cent. are determined from the gross amount of $54,926 allowed for engineering, but as that amount included $6360 for items of inspection of pile bridges, masonry, buildings and mechanical engineering which should be included in the costs of such work, the actual allowance for engineering is at the rate of $439 per mile, or 1.86 per cent. of the reported accounts mentioned.

This seems too low, and in supporting our claim for an allowance of five per cent. on such accounts, we submit:

1. An engineering program developed on a thirty-month construction program, amounting to $126,700, or approximately 4.85 per cent. on Accounts 3 to 47, as reported.

This program contemplates an expenditure of $1145 per mile of road.

2. In the Minnesota rate case the master allowed 4.5 per cent. on roadway items, including land.

3. In testimony before the Nebraska Railroad Commission the Chicago & Northwestern Railway submitted actual cost data on eight pieces of construction, varying from nineteen to 165 miles in length, total 569 miles, on which the average cost per mile of road was $1028.

In the same case the Rock Island submitted data showing that on 3205 miles of road the engineering cost averaged $1084 per mile of road, or 4.746 per cent. of Road Accounts.

And again the same road testified that on 11.1 miles of road constructed in Texas in 1908 the cost of engineering was $1096 per mile, and on 69.83 miles in Texas the cost was $937 per mile.

The carriers' brief, submitted to the Commission September 1, 1915, asked for a minimum sum of five per cent. of totals of roadway accounts (except lands).

In addition to the above, twelve cases are below submitted, the details of which are on file in the Western Group office.

State	Road	Miles	Engineering Cost Per Mile	Per Cent. Road Account Less Nos. 1, 2, 40, 41 and 47
Texas	G., C. & S. F.—Lometa West Extension	97.27	$1,345	5.054
Kansas	A., T. & S. F.—Dodge City & Cimarron Valley Extension	119.40	567	4.060
Arkansas	C., R. I. & P.—Little Rock & So. R. R.	144.40	1,300	5.548
Louisiana	C., R. I. & P.—R. I. A. & L. Ry. Co.	55.70	958	4.628
New Mexico	C., R. I. & P.—Tucumcari & Memphis Ry.	41.12	492	3.704
Arkansas	C., R. I. & P.—Malvern & Camden Ry.	55.10	1,643	6.517
Texas	St. L. & S. W. Ry. of Texas	63.15	738	3.092
Illinois	L. & N.—Cairo & Thebes R. R.	24.33	1,568	3.556
Oklahoma	M., K. & T. Ry.—Texas & Oklahoma	118.16	607	3.710
Oklahoma	M., K. & T. Ry.—M., K. & O. Ry.	271.44	663	4.205
Texas	San Antonio & Aransas Pass Ry.	36.70	555	5.636
California	Southern Pacific Co.—Mojave to Owenyo	142.68	1,118	3.197
	Average of 1169.45 miles		$989	4.239

With such supporting data and considering the conditions local to the Texas Midland, it is concluded that the report fails to allow a sum sufficient to cover the item of engineering expense and that a sum equal to five per cent. of Roadway Accounts (less lands) should be allowed.

None of the cases cited may be considered as covering all engineering costs, because the figures are offered by roads for extensions constructed, and many items of cost are absorbed by the parent company. Especially is this true for the time devoted to such extensions by the Chief Engineer of parent company and his general office organization, because prior to July 1, 1914, all that cost was precluded from such application by the Interstate Commerce Commission classification of operating expenses then effective.

ESTIMATED ENGINEERING ORGANIZATION AND ITS COST, TO REPRODUCE THE TEXAS MIDLAND RAILROAD IN THIRTY MONTHS.

ACTUAL CONSTRUCTION PERIOD EIGHTEEN MONTHS.

LENGTH OF LINE 110.549 MILES.

In planning the following engineering organization it is assumed that the railroad is going to be built, hence it contemplates employing the Chief Engineer from the beginning, and that he will be responsible for the finished property. He will establish an office and employ a small clerical force to carry on correspondence incident to later engineering organization, collecting prices of material, data for preparation of standards, etc.

It is assumed that the Chief Engineer would personally spend the first period of four months on reconnoissance work, the last two of which he would employ a full field party for random lines and other preliminary work. During the second period of eight months two field parties will be employed on location, one party for four months and the other for two months, to establish a final line. Camping provisions are contemplated for the preliminary and locating parties.

During the third or construction period of eighteen months the plan contemplates placing a competent district engineer in charge and also dividing the line into eleven construction residences of approximately ten miles each. As towns are situated at convenient intervals it is assumed that construction parties will find quarters and board thereat, and an additional pay allowance is accordingly made. The equivalent of seven construction engineering parties for the eighteen months are considered sufficient, as all of the ten-mile sections would not necessarily be covered at the same time.

1st Period Four Months	Reconnoissance, preliminary surveys, estimates and reports	Chief Engineer and his office expense	$3,520	
		Field party, 2 months	2,860	
		Proportion of instruments, equipment, etc.	120	
				$6,500
2d Period Eight Months	Final survey, location and estimates; Compliance with State requirements, securing bids, letting contracts, contractors moving to work, and partial acquisition of right of way	Chief Engineer and his office expense	$11,600	
		2 field parties, 3 months	8,580	
		Proportion of instruments and equipment	250	
				20,430
3d Period Eighteen Months	Construction—based on dividing line into eleven residencies	Chief Engineer	$21,600	
		District Engineer and 7 field parties	70,740	
		Special Engineering	1,300	
		Engineering instruments, etc.	1,630	
				99,770
			Total	$126,700

For details see Appendix "A."

LAND.

Has been considered by Division of Valuation in a separate report, and will be commented on by Land Committee and Counsel.

GRADING.

Clearing and grubbing has been estimated on basis of quantities as would be considered as existing as of date of valuation. The prices allowed are practically the same as originally paid.

The average prices paid for these items on lines in that or similar territory indicate that a fair unit price would be thirty-five dollars per acre clearing and fifty-two dollars per acre for grubbing.

Clearing and Grubbing Prices per Acre Paid Contractors.

State	Company	Locality or Line	Year	Clearing	Grubbing
Arkansas	C., R. I. & P.	Malvern-Kent	1911	$56.62	$87.12
Oklahoma	M., K. & T.	Grade Revision	1907	35.00	54.45
Oklahoma	M., K. & T.	M., K. & O. R. R.	1909	25.00	21.78
Oklahoma	M., K. & T.	Grade Revision	1909	40.00	43.56
Oklahoma	M., K. & T.	Texas & Oklahoma R. R.	1903	25.00	21.78
Oklahoma	M., K. & T.	Grade Revision	1907	25.00	65.25
Oklahoma	M., K. & T.	Grade Revision	1909	35.00	54.45
Oklahoma	M., K. & T.	Grade Revision	1906	35.00	65.25
		Average of above eight cases		$34.58	$51.70

In the above are no allowances for additional cost to company.

Excavation and Embankment.

Unit prices used seem to be about equivalent to those at time of construction of line. It is acknowledged that prices as of 1914 are substantially higher than those of preceding years. Although pay both ways has been allowed, the resulting estimate is low because relatively little of the material from cuts went into fills.

Prices allowed are:

Earth—In Excavation.....15 cents
Earth—In Embankment.....13 .5 cents
Loose Rock.....35 cents
Solid Rock.....65 cents and 80 cents
Hard Pan.....24 cents

In comparing these prices with prevailing prices as of 1914 they seem to be below the average.

Hard Pan.

The "hard pan" encountered requires the same method of handling as do loose and solid rock, and prices demanded for it by contractors vary from loose-rock price to eighty-five per cent. of that price.

It must be shot before handling either with shovel or team outfits.

Allowances for hard pan and other materials of such refractory nature have been made to contractors that indicate thirty-five cents as being a fair unit price.

The following prices have been paid for hard pan and materials of similar classification:

State	Road	Location or Line	Year	Cu. Yds.	Price
Various	C., B. & Q.	System	1910	2,703	.2945
Arkansas	C., R. I. & P.	Little Rock Southern	1905–07	Uncertain	.3500
Arkansas	C., R. I. & P.	Malvern Southern	1911	Uncertain	.3700
Montana	Nor. Pac.	Glendive East	1909	726,714	.2500
Illinois	E., J. & E.	Rockdale Branch		4,724	.3000
So. Dakota, No. Dakota, Montana	C., M. & St. P.		1906–09	1,000,065	.3826

In the cases of the Rock Island Company given above, hard pan was not provided for in specifications, but when encountered it was paid for at loose-rock prices.

The following cases where "pay-both-way" method was used give weight to the belief that higher unit costs should have been used:

Case 1.—In Oklahoma in 1902, in the construction of the Missouri, Kansas & Oklahoma Railroad (M., K. & T.), involving over one and one-half million cubic yards of earth excavation and four and one-quarter million cubic yards of earth embankment the unit price paid contractor for both excavation and embankment was fourteen cents. Loose-rock price was thirty-five cents and solid rock seventy cents. Contractor was charged a nominal rate of one cent per mile for transportation of men, and five mills per ton mile for equipment, rates clearly below the cost of that service and principally to prevent abuse of transportation privileges.

Case 2.—In Oklahoma in 1903, in the construction of the Texas & Oklahoma Railroad (M., K. & T.), involving about six hundred and seventy thousand cubic yards of earth excavation and over two and one-half million cubic yards of earth embankment, the unit price paid contractor for both excavation and embankment was thirteen cents. Loose-rock price was thirty cents and solid rock sixty-five cents. The same transportation charges being made as in Case 1.

Case 3.—In Oklahoma in 1907, on the Tyrola and Nigger Creek revision of the M., K. & T., involving over two hundred thirty thousand cubic yards of earth work, earth price was twelve and a half cents, loose rock thirty-five cents and solid rock sixty cents, with free transportation.

Case 4.—In Oklahoma in 1909, on the Newalla revision of the M., K. & T., involving about ninety-two thousand cubic yards of earthwork, earth price was twelve cents, loose rock thirty cents and solid rock sixty cents, with free transportation.

Case 5.—In Oklahoma in 1907, on Limestone Gap Grade revision of the M., K. & T., involving over seventy-seven thousand cubic yards of earthwork, earth price was twenty cents, loose rock thirty-five cents and solid rock sixty-five cents, with free transportation.

A summary and weighted average of the foregoing five cases shows for

9,530,107 cubic yards, Earthwork.....13.65 cents
647,873 cubic yards, Loose Rock..... 33.47 cents
794,373 cubic yards, Solid Rock..... 67.62 cents

(See Appendix "B" for details.)

In addition, the total overhaul cost applied to the total yardage amounts to twenty-eight one-hundredths of one cent per cubic yard.

In the "pay-two-way" cases cited it will be noted that it is the practice to bid the same price for embankment as for excavation, the contractor reserving as his right the privilege of using materials from excavation for making embankment when haul conditions justify, and if fifteen cents per cubic yard is a fair rate for earth excavation, at least as high a rate should apply to embankment.

In the cases above cited the carrier furnished transportation free or at a nominal charge, which condition could not obtain on the Texas Midland, so the unit prices shown are not representative of those that would be obtained from contractors bidding on this work.

The Texas Midland in 1913 paid nineteen cents per cubic yard for grading on its line, the work being let to a local contractor. The bid of nineteen cents being the lowest of four, the highest being twenty-two cents.

Additional Costs over Contract Prices.

A study of many jobs involving a total of over ninety-six million yards shows that the cost to railroad companies for grading work, over and above the units paid for at contract prices, averages about four cents per cubic yard, which additional unit cost should be applied to the unit prices stated in the above five cases to ascertain the total unit cost.

STATEMENT showing cost of grading work in excess of units paid at contract prices—being twenty-four cases in different parts of United States.

Summary of Twenty-four Cases.

96,245,904 cubic yards.

	Amount	Per Cubic Yard
Transportation of men	$1,033,701	$.0107
Transportation of equipment and supplies	754,510	.0078
Force account and company labor not itemized	1,539,029	.0160
Dressing roadbed	110,680	.0012
Repairing washouts	30,927	.0003
Moving fences and telephone lines	4,152	.0001
Channel changes	13,459	.0001
Temporary roads	17,250	.0002
Temporary tracks	1,645	.0000
Damages account waste banks and borrow pits	5,882	.0001
Commissary deficit	443	.0000
Delays and labor troubles	37,173	.0004
Stock killed and injuries to persons	154	.0000
Train service	37,361	.0004
Rent and repair of equipment	60,898	.0006
Contractor's percentage	234,183	.0024
Other miscellaneous charges	33,899	.0004
Total	$3,915,346	$.0407

NOTE.—The following sheets contain the figures for the twenty-four cases from which the summary above has been compiled.

	Chicago, Milwaukee & St. Paul Railway						Gt. Nor. Ry.	
	Glenham-Harlowton, Lombard-Butte 22,526,223 Cubic Yards		Double Track in Louisiana, Minn. & S. D. 27,848,737 Cubic Yards		Crystal Falls-Iron River 871,315 Cubic Yards		Niobe-North Line 399,851 Cubic Yards	
	Amount	Per Cubic Yard	Amount	Per Cubic Yard	Amt.	Per Cubic Yard	Amt.	Per Cubic Yard
Transportation of men	$464,473	$.0206			$4,082	$.0047	$2,624	$.0065
Transportation of equipment and supplies	82,323	.0036	$171,556	$.0062	3,138	.0036		
Force account and company labor not itemized	668,728	.0297	620,720	.0223	1,849	.0021	987	.0025
Dressing roadbed					655	.0007		
Repairing washouts								
Moving fences and telephone line					194	.0002	147	.0004
Channel changes					48	.0001		
Temporary roads					1,332	.0015		
Temporary tracks								
Damages account waste banks and borrow pits							25	.0000
Commissary deficit								
Delays and labor troubles								
Stock killed and injuries to persons								
Train service							186	.0005
Rent and repair of equipment								
Contractor's percentage	231,982	.0103					2,201	.0055
Other miscellaneous charges								
Total	$1,447,506	$.0642	$792,282	$.0285	$11,298	$.0129	$6,170	$.0154

	Chicago & Northwestern Ry.				Nor. Pac. Ry.		C., B. & Q. R. R.	
	Milwaukee-Sparta 10,644,395 Cubic Yards		Peoria-Girard 5,162,398 Cubic Yards		Glendive-East 3,581,889 Cubic Yards		Herrin & Southern 2,261,962 Cubic Yards	
	Amount	Per Cubic Yard	Amount	Per Cubic Yard	Amt.	Per Cubic Yard	Amt.	Per Cubic Yard
Transportation of men	$96,443	$.0091			$214,556	$.0599	$11,619	$.0051
Transportation of equipment and supplies	159,666	.0150	$895	$.0001	83,005	.0232	13,773	.0061
Force account and company labor not itemized	98,589	.0093					12,283	.0054
Dressing roadbed								
Repairing washouts	7,884	.0007						
Moving fences and telephone line	1,092	.0001						
Channel changes								
Temporary roads								
Temporary tracks								
Damages account waste banks and borrow pits							2,975	.0013
Commissary deficit								
Delays and labor troubles								
Stock killed and injuries to persons								
Train service	2,590	.0002	10,277	.0020			13,219	.0059
Rent and repair of equipment	1,709	.0002	32,465	.0063	16,294	.0045	2,470	.0011
Contractor's percentage								
Other miscellaneous charges	5,467	.0005						
Total	$373,440	$.0351	$43,637	$.0084	$313,855	$.0876	$56,339	$.0249

	Colorado R. R.		Union Pacific Railroad				O. S. L. R. R.	
	Dixon-Cheyenne 2,613,178 Cubic Yards		Hastings-Gibbon 404,592 Cubic Yards		Callaway-Stapleton 669,737 Cubic Yards		Teton-Basin Branch 990,684 Cubic Yards	
	Amount	Per Cubic Yard	Amount	Per Cubic Yard	Amt.	Per Cubic Yard	Amt.	Per Cubic Yard
Transportation of men			$4,999	$.0123	$3,618	$.0054	$13,749	$.0139
Transportation of equipment and supplies	$24,815	$.0095	11,443	.0283	2,132	.0032	6,345	.0064
Force account and company labor not itemized			528	.0013	275	.0004	15,394	.0155
Dressing roadbed								
Repairing washouts					299	.0004		
Moving fences and telephone line								
Channel changes								
Temporary roads								
Temporary tracks							507	.0005
Damages account waste banks and borrow pits								
Commissary deficit								
Delays and labor troubles							614	.0006
Stock killed and injuries to persons								
Train service					448	.0007	477	.0005
Rent and repair of equipment								
Contractor's percentage								
Other miscellaneous charges	6,305	.0024	183	.0005	20	.0000	1,130	.0011
Total	$31,120	$.0119	$17,153	$.0424	$6,792	$.0101	$38,216	$.0385

	O.-W. R. R. & N.		Chicago, Rock Island & Pacific Railway					
	Des Chutes Railroad 3,556,945 Cubic Yards		Carlisle-Allerton 4,689,512 Cubic Yards		Haskell, Eldorado & Crossette 4,406,208 Cubic Yards		Malvern-Kent 1,576,005 Cubic Yards	
	Amount	Per Cubic Yard	Amount	Per Cubic Yard	Amt.	Per Cubic Yard	Amt.	Per Cubic Yard
Transportation of men	$126,115	$.0355	$24,982	$.0053	$49,021	$.0111	$13,274	$.0084
Transportation of equipment and supplies	118,201	.0332	43,415	.0093	11,282	.0025	15,444	.0098
Force account and company labor not itemized	37,234	.0105			21,855	.0049		
Dressing roadbed	65,526	.0184	28,208	.0060	11,735	.0027		
Repairing washouts							3,904	.0025
Moving fences and telephone lines	150	.0000	366	.0001				
Channel changes	13,346	.0038					65	.0000
Temporary roads	15,918	.0045						
Temporary tracks								
Damages account waste banks and borrow pits	280	.0001					520	.0003
Commissary deficit	46	.0000						
Delays and labor troubles			36,434	.0078				
Stock killed and injuries to persons	1,820	.0005	675	.0001				
Rent and repair of equipment	2,950	.0008			4,928	.0011		
Contractor's percentage								
Other miscellaneous charges			7,404	.0016	241	.0001	8,554	.0054
Total	$381,586	$.1073	$141,484	$.0302	$99,062	$.0224	$41,761	$.0264

	Ill. Cent.		Mo. Pac. Ry.		Kansas City Southern Ry.			
	Memphis & State Line 515,329 Cubic Yards		Cairo-Thebes 1,611,472 Cubic Yards		Line Change M. P. 30 356,749 Cubic Yards		Line Change M. P. 89 322,855 Cubic Yard	
	Amount	Per Cubic Yard	Amount	Per Cubic Yard	Amt.	Per Cubic Yard	Amt.	Per Cubic Yard
Transportation of men					Free		Free	
Transportation of equipment and supplies			$1,769	$.0011	Free		Free	
Force account and company labor not itemized	$568	$.0011	21,670	.0134	$16,115	$.0452	$22,228	$.0688
Dressing roadbed	3,312	.0064			1,244	.0035		
Repairing washouts							17,715	.0549
Moving fences and telephone lines	2,203	.0043						
Channel changes								
Temporary roads								
Temporary tracks					1,048	.0029		
Damages account waste banks and borrow pits			1,672	.0010				
Commissary deficit								
Delays and labor troubles							125	.0004
Stock killed and injuries to persons								
Train service					7,669	.0215		
Rent and repair of equipment								
Contractor's percentage								
Other miscellaneous charges	546	.0011	726	.0005	1,827	.0051		
Total	$6,629	$.0129	$25,837	$.0160	$27,903	$.0782	$40,068	$.1241

	St. L. S. W. Ry.		K.C.,M.& B.R.R.		Ft. W. & R. G.		M., L. & T. R. R. & S. S.	
	Idalia-Dexter 2d Track 87,736 Cubic Yards		Empire Branch Extension 179,355 Cubic Yards		Brady-Menard Extension 904,479 Cubic Yards		Bayou Sale Branch 64,298 Cubic Yards	
	Amount	Per Cubic Yard	Amount	Per Cubic Yard	Amt.	Per Cubic Yard	Amt.	Per Cubic Yard
Transportation of men	$701	$.0080	$805	$.0045	$2,617	$.0029	$23	$.0004
Transportation of equipment and supplies	687	.0078	650	.0036	3,134	.0035	837	.0130
Force account and company labor not itemized								
Dressing roadbed								
Repairing washouts							1,125	.0175
Moving fences and telephone lines								
Channel changes								
Temporary roads								
Temporary tracks	90	.0010						
Damages account waste banks and borrow pits	300	.0035			110	.0001		
Commissary deficit	397	.0045						
Delays and labor troubles								
Stock killed and injuries to persons	154	.0018						
Train service								
Rent and repair of equipment							82	.0013
Contractor's percentage								
Other miscellaneous charges	717	.0082	325	.0018			454	.0070
Total	$3,046	$.0348	$1,780	$.0099	$5,861	$.0065	$2,521	$.0392

Not having had access to notes of the Government, and without having made a detailed study of quantities in excavation and embankment, but from information at hand, it is concluded that the following unit prices should be allowed for grading Texas Midland:

Earth Excavation and Embankment.....18 cents
Hard Pan.....35 cents
Loose Rock.....38 cents
Solid Rock.....72 cents

Attention is particularly called to the allowance in report of thirteen and a half cents per yard for borrow, which will come from what is described as "black-waxy" or gumbo material, and of fifteen cents for excavation on the hills of "sandy loam," indicating an erroneous conclusion, and that if any difference should be made in unit costs their application should be reversed.

BRIDGES, TRESTLES AND CULVERTS.

Assumption is made in the report that all material for culverts and small bridges is hauled by team, and the erection completed in advance of track-laying. The average haul can only be determined by detailed study of the line and a full knowledge of conditions. The report shows

14,178 lineal feet pile trestles are inventoried (T.M.–1–T) at $166,618 or $11.75 per foot.

9055 lineal feet at $107,146 or $11.83 per foot (T.M.–6–T).

These prices per lineal foot are not as great as those reported by carriers who have constructed pile trestles on lines already in existence where there is every facility for economical and rapid construction.

Lack of detail prevents analysis of items entering into cost of material and labor on pile trestles, and it seemed best to make comparisons on basis of lineal feet of bridging built—having in mind structures of similar type (three-ply stringers on four-pile bents, using treated or bois d'arc piling and caps, and untreated decking) and also that bridges are of an average height of about twelve feet.

In replacing an eighty-four-foot bridge ten feet high, that was burned in 1915, the actual cost was $16.75 per lineal foot to the Texas Midland, and there was available the organization and

delivery facilities of a railroad in operation, which produced a cost that could not be equaled under "Construction New" program.

In Texas on the construction of a new line of the St. Louis Southwestern of Texas, seventy-three pile trestles were built in 1911-12. Total length 12,872 feet. Maximum length 1694 feet, average length 176.3 feet. Four oak piles to bent, spans fourteen feet, three-ply 7 x 16 stringers, at an average cost of $14.05 per lineal foot.

In Texas on the Brady-Menard Extension of the Fort Worth & Rio Grande Valley, built in 1910, pile trestles aggregating 3840 feet. Four and five L. L. Y. P. and oak piles to bent, average height 11.7 feet, spans fifteen feet, three-ply 8 x 16 L. L. Y. P. stringers, at an average cost of $13.35 per lineal foot.

In Oklahoma on the Missouri, Kansas & Texas, three pile trestles were built in 1909, aggregating 453 feet, four and five oak piles to bent, spans fifteen feet, three-ply 7 x 15 stringers, at an average cost of $13.73 per lineal foot.

In Arizona on the Arizona & Eastern, 1200 feet of pile trestle was built in 1910. Four untreated piles to bent, average height of bridge ten feet, spans fifteen feet, three-ply 8 x 17 stringers, at an average cost of $14.50 per lineal foot.

In constructing the Lometa extension of the Gulf, Colorado & Santa Fe Railroad, built in 1910, there was built 13,491 lineal feet of trestle bridging with treated timber in substructure and untreated timber in superstructure at an average cost of $15.51 per lineal foot.

The price of seventy-one cents per lineal foot of treated and bois d'arc piling in place allowed in the report is too low, as is evidenced by the following carefully prepared estimate of the cost of creosoted piling in place on the Texas Midland bridges between Commerce and Paris, Texas:

Untreated piles at Texarkana, Ark.	$.080
Treatment	.205
Store and material yard expense	.021
Freight to commerce	.080
Team haul to front	.100
Transportation of men, outfits and supplies	.037
Driving	.225
Miscellaneous	.059
Total cost per foot in place	$.807

In view of the foregoing, and of the fact that on the Texas Midland seventy-eight per cent. of the piling is bois d'arc and twenty-two per cent. creosoted pine (the untreated being less than one per cent. and negligible) and thirty-seven per cent. of the caps are of bois d'arc, it is believed that unit prices should be applied to material in these trestle bridges that would bring their new value to at least $16 per lineal foot.

If this is done we believe it would not then represent their full reproduction intrinsic value, because bois d'arc, a material no longer obtainable at any price in sizes for that purpose, has an undetermined life value, in any case not less than twice that of the best creosoted material that could be produced. While the question of substitution of materials for those found in work and not now obtainable is one that cannot generally be considered in this case, it would at least be fair to use it as a guide to provide an allowance equal to the best available treated material, and this is the basis of the price recommended. The report indicates that this has been attempted, but in the light of experience, we believe that through some omission or error in unit prices of creosoted piling and of other lumber in place in 1914, it has failed to determine the full reproduction cost.

Concrete (Culverts and Piers).

The amount of information contained in inventory report is so little that we are deprived of the opportunity to properly check the costs applied.

Concrete in foundations is priced at $11.30 per cubic yard, while in pier work it is priced at $9.10. At another point it is priced at $10.90 in foundations and $8.90 in piers, and in a box culvert it is priced at $9 per cubic yard. It is presumed that these figures are intended to include the necessary coffer-dam work as well as excavation, as no allowance appears for these items elsewhere.

In 1910 and 1911 the Santa Fe, on the Lometa extension in Texas, constructed concrete work amounting to 8102 cubic yards at a cost of $111,128. There were 4813.14 cubic yards of pier and abutment work for steel bridges, averaging $15.35 per

cubic yard, and 3288.57 yards concrete culvert work, averaging $11.02 per yard. The average cost of all concrete work being $14.24 per cubic yard.

(See completion report as submitted to Mr. Worley April 27, 1916.)

The actual contract cost in 1909 on one pier of Trinity River Bridge was $13.50 per yard of concrete in place, no charges being made for transportation of plant, men and materials.

To cover construction cost, with conditions as would exist in building a line of this type, a unit price of not less than $11 per yard should be allowed for culvert work and $15 per yard for pier work.

Steel Bridges (Superstructures).

Checking the superstructure tonnage and costs with statistics available of structures of a similar nature in that vicinity (Oklahoma $87.33 per ton, Texas $82.23 per ton, Texas $81.23 per ton and Texas $82.65 per ton), the prices allowed of $82.70 per ton do not seem sufficient to cover the unforeseen contingent costs encountered in work on new lines.

Considering the careful maintenance and frequent painting, the depreciation of superstructure of steel bridges on the Texas Midland applied in the report seems too great, and the allowance for scrap value not enough.

These bridges are heavy enough for all present and prospective loads, and if present maintenance policy is adhered to, their life would be very much greater than ordinarily expected under very heavy traffic conditions.

Ties.

The inventory shows only ties actually in track and no allowance is made for wastage loss or for cost of handling, the report stating that these allowances are included under track-laying and surfacing. Allowances for wastage in track material is made and it should be made for ties.

On the Winston-Salem Southbound Railway a wastage loss of 6.9 per cent. of cross-ties is reported.

The price allowed in the report for burnettized ties at fifty-six cents is much too low, as they actually cost the company seventy-eight cents delivered.

Average cost of pine ties delivered to the Chicago, Burlington & Quincy Railroad in 1914 was fifty-three cents. Treatment by burnettizing process (no freight added) cost 16.49 cents and 17.52 cents in 1914. Total cost, 69.49 cents and 70.52 cents.

Carriers in vicinity of northern Texas reported on Order No. 14 cost prices of pine ties in years 1913 and 1914 of thirty, forty-one and forty-eight cents. To this should be added cost of treatment and freight.

The prices allowed in the report are those of ties delivered on line of Texas Midland, with no contingencies considered. This fact must be remembered when considering track-laying and surfacing estimates.

Rail.

Unit prices are applied on basis of ninety-five per cent. first class and five per cent. second class. It should be remembered that in the purchase of rail a contract is made for a certain tonnage of first-class rail, and that in addition to this tonnage the carrier agrees to take from the manufacturer an amount of second-class rail not to exceed five per cent. of the tonnage contracted for.

This amount is not always taken, but assuming that it is, the proportion of No. 1 rail is 95.24 per cent. and of No. 2 rail is 4.76 per cent. In this respect the assumption is in error although the difference in actual cost may not be great.

The service life of this rail is given as twenty-five years for main track. Much of it has already been in service twenty-three years, and with the same class of power in use on this line, and the little wear that has occurred in the rail, its life can readily be extended for an indefinite period. The prospective density of tonnage, or train service and of wheel loads, are not such as to make necessary the replacement of main track rail for many years, and it may reasonably be presumed that at least thirty-five years' life will be obtained before it is removed from main track. The rail shows little signs of wear. Loss from corrosion is negligible, and the fact that no failures occur indicate that it is not subjected to strains beyond its capacity to withstand. Considering prospective requirements an allowance should be made for an initial life of not less than thirty-five years.

Other Track Material.

The report says: "Angle bars are given the same service condition assigned to the cycle of rail with which they were associated."

At the end of the first cycle the rail is given a relay value and angle bars are considered as scrap, whereas they are largely usable for relaying purposes. The General Manager of the road reports that all bars released on certain relaying work were put in service on side tracks when rail was relaid.

The following letter on service of angle bars is submitted to show the experience of the Chicago, Burlington & Quincy Railroad:

"May 22, 1916.

"MR. JOHN S. WORLEY,
Member, Engineering Board, Division of Valuation,
Kansas City, Mo.

DEAR SIR:—

"Referring to your letter of May 16th to Mr. Sparrow, making inquiry with reference to the practice of our road and our experience with angle bars:

"1st. 'What per cent. of angle bars is renewed before rail is first taken out of main track and becomes relay rail?'

"This is a hard question to answer, because we have no method of arriving at these facts, but for your information we had occasion to study the results being obtained by high-carbon angle bars on the Burlington System and out of some 112,000 pair we have no record of a replacement being made because of failure of bars. For this reason I think you may reasonably neglect the question of renewals."

"2d. 'What per cent. of the original angle bars is removed from main track at the time rail becomes relay and is used with relay rail when it is placed in its new location as relay?'

"We assume that practically 100 per cent. of the original angle bars are removed from main track at the time rail becomes relay."

"3d. 'What per cent. of new angle bars is purchased and used at the time relay rail is first laid as relay?'

"This question came up in 1915 and observations made of the condition of angle bars and continuous joints released during 1915 on eighty-five-pound, ninety-pound and one-hundred-pound rail that was taken up and relaid elsewhere. The maximum scrap on any of these jobs was slightly more than fifteen per cent.—in fact, between eighty per cent. and eighty-five per cent. of all our angle bars released last year went back into service in our relaying work."

"I trust this will give you the information you desire.

Yours truly,
(Signed) A. W. NEWTON,
Assistant to President."

Ballast.

The prices for sand and cinder ballast do not include any cost for material other than cost of loading. Assumption is also made that all cinders originated at Terrell. The railroad not being in operation cinders would have to be procured from outside sources, and as they are a marketable product, being used for various purposes, it cannot be assumed that there is no cost other than that of loading. Furthermore, construction work would create a demand for such material and even higher than ordinary prices would have to be paid. It can only be assumed that cinders as well as sand must be purchased for the purpose of ballasting the road in a reproduction-new program.

In 1909, 20,000 cubic yards of sand cost unloaded on tracks of a branch line on the Chicago, Burlington & Quincy Railroad 41.6 cents per cubic yard. In the same year 25,200 yards of cinder ballast cost per yard:

Material	30.3 cents
Work Train	6.9 cents
Unloading	5.9 cents
	43.1 cents

The price allowed for burnt-clay ballast is lower than that at which it can now be produced, as cost of burning is much greater. In 1900, contracts were made by the Burlington by which it was burned for 53.1 cents per cubic yard, while

in 1912 and 1913 the cost had increased to 69.5 cents and 77.9 cents. Add to these costs the freight on coal (for which that road has made no charge), the cost of loading, train service and of unloading, the cost of burnt-clay ballast delivered, easily becomes ninety cents per yard or more.

If proper allowance for its application is included in track-laying and surfacing, it would seem that prices allowed for cost of stone and burnt-clay ballast laid down on track are fairly reasonable, but those allowed for cinders and sand should be increased to at least forty cents each. The shrinkage allowance for cinders should also be increased to not less than twenty per cent.

Track-laying and Surfacing.

The report says:

"The unit prices for track-laying and surfacing in addition to that specified in the classification of accounts includes the expense of maintaining material yards, handling and loading ties and rails at material yards, and unloading, handling and reloading other track material, Account 10, and other incidental material yard expenses which a strict interpretation of the classification of accounts requires to be allocated to each individual item of property, regardless of the insignificance of the expense of total cost of the item of property. Such refinement is impracticable of application in this work."

Considering this statement it is reasonable to assume that not only all labor of handling, but all incidental expenses properly chargeable to the various items are intended to be included in track-laying and surfacing, and that the items of material as charged to their respective accounts are at cost price at delivery point on the Texas Midland Railroad, with no incidental costs such as handling, inspection, etc., included, except in the case of ballast.

A careful study of the actual costs of track-laying and surfacing on several roads on which similar conditions would be encountered, such as weight of rail, general character and approximately same amount of ballast (about 2600 cubic yards per mile) and its accessibility, indicates that the weighted average

cost per mile for this item, determined from the report, is much below what experience demonstrates to be the usual cost of such work. Consequently, it can only be concluded that in assembling the items comprising the estimate, some of importance such as expenses of handling rails, ties, etc., into and in material yards, cost of ice, extra fuel costs, personal injuries, cost of track maintenance during construction and other items, sometimes individually small and obscure, but of material importance in the aggregate, must have been overlooked.

A case in illustration is that of the Lometa extension of the Gulf, Colorado & Santa Fe, where the cost of track-laying and surfacing (not including ballasting, as none was done) 97.27 miles of main and 15.13 miles of side track, total 112.40 miles, was $1534.40 per track mile, including the following items:

"The cost of hauling all track material from material yard to the front and distributing same, cost of laying and surfacing the track, including all necessary train service, fuel for engines and outfits, water, ice, temporary water stations, fitting up bunk cars, track tools, transportation of men and miscellaneous expense, and maintenance of track during construction."

"No material yard expense is included in this cost. All material yard expense was charged to the material handled."

"The labor laying track includes the cost of unloading, distributing and spacing the ties, laying the rail; full bolting, full spiking, tie-plating, gauging and rough-lining the track."

"Surfacing included all the additional work necessary to bring the track to a finished surface and correct line."

Owing to the short period between the time the report was available to the Committee, on May 15th, and the hearing on it before the Director of the Division of Valuation, on May 26th, and to the lack of detail therein, this Committee was unable to study, analyze and prepare for presentation more of the report than is covered by the foregoing subjects, up to and including "track-laying and surfacing." From such examination as could be made of the remainder, however, it seems that values as developed are insufficient.

APPENDIX "A."

The detail of the estimated engineering organization for the reproduction of the Texas Midland being as follows:

1st Period, Four Months — Reconnoissance and preliminary estimate; raising capital and making arrangements to insure its delivery when required; incorporation under State laws

Chief Engineer	@	$400 per mo.	
Chief Clerk	@	125 " "	
Stenographer	@	75 " "	
Office Rent	@	25 " "	
Livery	@	120 " "	
Chief Engineer's expense	@	120 " "	
Office Supplies	@	15 " "	
		$880 x 4 mos.	$3,520

FIELD PARTY.

Location Engineer	@	$150 per mo.	
Transitman	@	100 " "	
Levelman	@	90 " "	
Topographer	@	90 " "	
Draftsman	@	90 " "	
Rodman	@	60 " "	
2 Chainmen	@	100 " "	
Tapeman	@	50 " "	
Flagman	@	40 " "	
2 Axemen	@	120 " "	
Cook	@	60 " "	
Camp Helper	@	30 " "	
Team and Driver	@	120 " "	
Provisions	@	320 " "	
Office Supplies	@	10 " "	
		$1,430 x 2 mos.	2,860
Proportion cost, less salvage 1 set instruments.			20
Camp equipment, less salvage			100
			$6,500

2d Period, Eight Months — Final survey, location and final estimate; compliance with requirements of State Public Service Commission; sale of stocks and bonds, letting contracts and partial acquisition of right of way

Chief Engineer	@	$400 per mo.	
Office Engineer	@	220 " "	
Chief Clerk	@	125 " "	
Stenographer	@	75 " "	
Computer, etc	@	90 " "	
2 Draftsmen	@	200 " "	
Messenger, etc	@	40 " "	
Office Rent	@	50 " "	
Livery	@	120 " "	
Chief Engineer's expenses	@	120 " "	
Office Supplies	@	30 " "	
		$1,450 x 8 mos.	$11,600

FIELD PARTY.

Location Engineer	@	$150 per mo.	
Transitman	@	100 " "	
Levelman	@	90 " "	
Topographer	@	90 " "	
Draftsman	@	90 " "	
Rodman	@	60 " "	
2 Chainmen	@	100 " "	
Tapeman	@	50 " "	
Flagman	@	40 " "	
Stakeman	@	40 " "	
2 Axemen	@	80 " "	
Cook	@	60 " "	
Camp Helper	@	30 " "	
Team and Driver	@	120 " "	
Provisions	@	320 " "	
Office Supplies	@	10 " "	
		$1,430 x 6 mos.	8,580
Proportion cost, less salvage 1 set instruments			90
Camp Equipment, less salvage			200
			20,430

3d Period, Eighteen Months — Construction

Chief Engineer and office expenses and $1,450 x 18 mos.			$26,100

FIELD PARTIES.

District Engineer	@ $220	$220 per mo.	
7 Resident Engineers	@ 150	1,050 " "	
7 Instrumentmen	@ 90	630 " "	
7 Rodmen	@ 70	490 " "	
7 Tapemen	@ 60	420 " "	
7 Axemen	@ 50	350 " "	
7 Teams and Drivers	@ 110	770 " "	
		$3,930 x 18 mos.	70,740
2 sets instruments from location party, less salvage and 5 sets instruments new, less salvage			1,630
Special engineering fees for designing and specifications for steel bridges and substructure 2½ per cent. of $52,000			1,300
			99,770
Total			$126,700

APPENDIX "B."

GRADING—PAY BOTH WAYS.

Case 1.

M., K. & T.

Coffeyville, Kan., to Osage, Okla.
Osage to Oklahoma City
Fallis to Guthrie
Osage to Wybank
} 1902.

Earth	1,560,446	cubic yards	Excavation	@ 14c.—	$218,462.44	Transportation of men @ $0.01. Transportation of equipment and supplies @ $0.005. Amount unknown.
Earth	4,264,977	" "	Embankment	@ 14c.—	597,096.78	
L. R.	350,587	" "		@ 35c.—	122,705.45	
S. R.	445,901	" "		@ 70c.—	312,130.70	
Total	6,621,911	" "				
O. H.	2,068,952	" "		@ 1c.—	20,689.52	

Case 2.

Oklahoma City—Colgate, 1903.

Earth	669,629	cubic yards	Excavation	@ 13c.—	$87,051.82	Transportation of men @ $0.01. Transportation of equipment and supplies @ 5 mills. Amount unknown.
Earth	2,635,180	" "	Embankment	@ 13c.—	342,573.45	
L. R.	199,103	" "		@ 30c.—	59,730.93	
S. R.	304,871	" "		@ 65c.—	198,166.21	
Total	3,808,783	" "				
O. H.	532,990	" "		@ 1c.—	5,329.90	

Case 3.

Tryola and Nigger Creek Division, 1907.

Earth	230,841	cubic yards	Exc. and Emb.	@ 12½c.—	$28,855.15	Transportation free. Amount unknown.
L. R.	18,398	" "		@ 35 c.—	6,572.66	
S. R.	23,222	" "		@ 60 c.—	13,933.35	
Total	272,271	" "				

Case 4.

Newalla Revision—North of Shawnee, Okla., 1909.

Earth	91,734	cubic yards	Exc. and Emb.	@ 12c.—	$11,008.08	Transportation free. Amount unknown.
L. R.	2,879	" "		@ 30c.—	863.70	
S. R.	6,259.7	" "		@ 60c.—	3,755.82	
Total	100,873	" "				
O. H.	95,804	" "		@ 1c.—	958.04	
O. H.	228,415	" "		@ 1c.—	2,284.15	

Case 5.

Limestone Gap Revision—1910.

Earth	77,299	cubic yards	Exc. and Emb.	@ 20c.—	$15,459.80	Transportation free. Amount unknown.
L. R.	77,097	" "		@ 35c.—	26,983.95	
S. R.	14,119	" "		@ 65c.—	9,177.35	
Total	168,515	" "				
O. H.	151,510	" "		@ 1c.—	1,515.10	

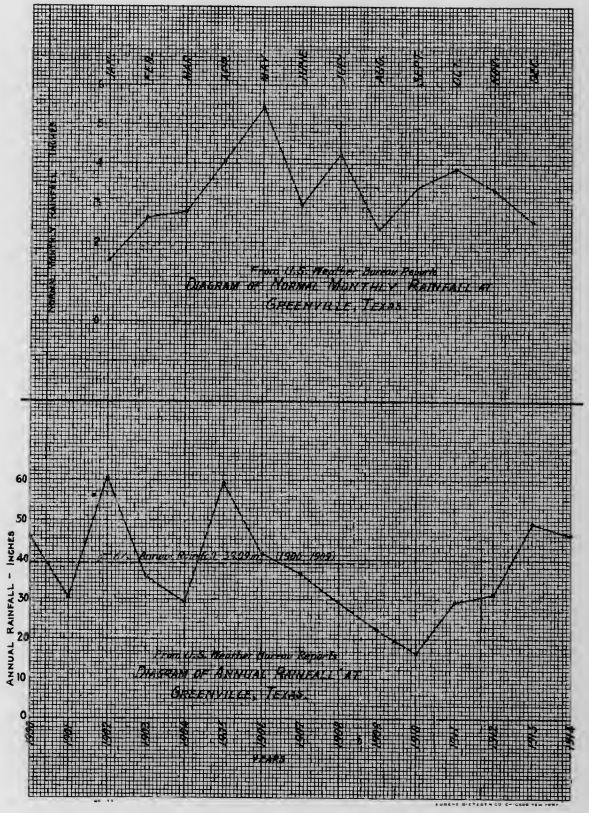
Extension, Revision and Miscellaneous Work, 1907–1911.

Earth, 165,600	cubic yards	@ 13½c. (Av.).	
L. R.	40,400 " "	@ 36½c. (Av.).	
S. R.	37,400 " "	@ 63½c. (Av.).	
O. H.	7,500 " "	@ 1c.	

APPENDIX "B"—Continued.

Contract prices on the pay-both-ways basis as shown on various jobs submitted by the Missouri, Kansas & Texas Railway range from twelve cents to twenty cents for earth with an average of 13.6 cents. Contract for 271 miles of new work in Oklahoma was let at fourteen cents for excavation and fourteen cents for embankment. On that same job loose rock was paid for at thirty-five cents per yard and solid rock at seventy cents. Transportation of men cost contractor one cent per mile and transportation of equipment five mills per ton mile. The amount of the last two items are unknown.

APPENDIX "C."

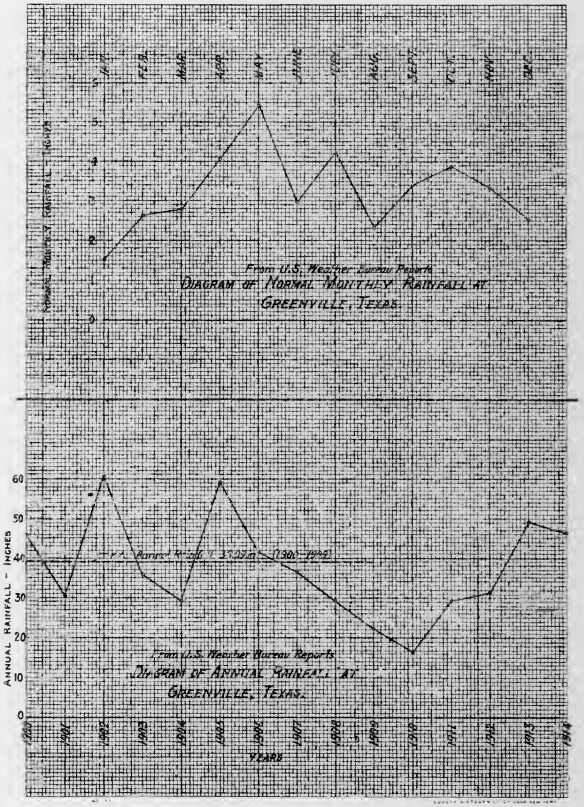


INTENTIONAL SECOND EXPOSURE

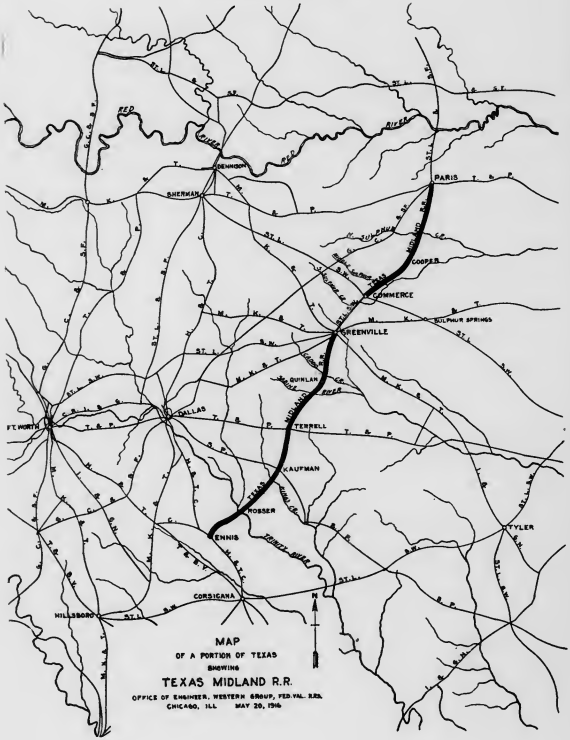
APPENDIX "B"—Continued.

Contract prices on the pay-both-ways basis as shown on various jobs submitted by the Missouri, Kansas & Texas Railway range from twelve cents to twenty cents for earth with an average of 13.6 cents. Contract for 271 miles of new work in Oklahoma was let at fourteen cents for excavation and fourteen cents for embankment. On that same job loose rock was paid for at thirty-five cents per yard and solid rock at seventy cents. Transportation of men cost contractor one cent per mile and transportation of equipment five mills per ton mile. The amount of the last two items are unknown.

APPENDIX "C."



APPENDIX "D."


RED RIVER
DENISON
SHERMAN
PARIS
COMMERCE
GREENVILLE
SULPHUR SPRINGS
QUINLAN
FT. WORTH
DALLAS
TERRELL
KAUFMAN
ROSSER
ENNIS
TYLER
CORSICANA
HILLSBORO
N
MAP
OF A PORTION OF TEXAS
SHOWING
TEXAS MIDLAND R.R.
OFFICE OF ENGINEER, WESTERN GROUP, FED. VAL. R.R.
CHICAGO, ILL. MAY 20, 1916

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